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A comparison of inventory methods applicable to the western fox squirrel, Sciurus niger rufiventer (Geoffroy)

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A COMPARISON OF INVENTORY METHODS APPLICABLE TO THE WESTERN FOX SQUIRREL, SCIURUS NIGER RUFIVENTER (GEOFFROY)

by

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INTRODUCTION

The fox squirrel, Sciurus niger rufiventer (Geoffroy), is an important game mammal species in Iowa. It is found over all of the state and is to be seen at all seasons of the year. Because of its wide distribution and its year-round activities, it is very widely known.

As a game species the fox squirrel is very similar to the cottontail, Sylvilagus floridanus mearnsii (Allen). Both are present in large numbers, the haunts of each are easily accessible and the sporting equipment needed to bag either species is restricted and comparatively simple. Consequently, the fox squirrel affords a great deal of enjoyment and pleasurable pastime to farmers, farm boys and urban dwellers who prefer a light but exciting type of hunt.

In years previous to our widespread agricultural development the fox squirrel depended entirely upon wild natural growth for food. With the clearing of land for crop use there was forthcoming an increased ideal habitat with an augmented food supply in the form of corn. The fox squirrel is a border-land creature compared with the gray squirrel, Sciurus carolinensis leucotis (Gapper). The former likes both woods and open tracts. As a consequence it is to be found where the two meet or where there is an intermingling of portions of each. The gray squirrel, however, is truly a tree squirrel and is to be found almost exclusively in timber stands. With the increase of its preferred habitat, the fox squirrel population has correspondingly increased, to such an extent in some areas as to constitute a detriment to the farmer. Its depredations are not very widespread, though, and are usually most noticeable where a corn field adjoins timber land. In such an instance the border rows may be stripped of grain. In most instances however, this increased population has been welcomed as assurance of a more plentiful supply of a desirable game animal.

In the days of settlement and adjustment game was killed by man primarily to furnish a part of his food. His interests were too thoroughly absorbed by primitive needs for him to use time and materials to satisfy a sporting desire. As leisure time could gradually be worked into his daily routine, shooting for sport could be accomplished without interfering with essential duties.

Good squirrel habitat has been increased through the encroachings of agriculture with a consequent increase in the animal population. Along with the growing animal population there has been a continuous growing interest, on the part of the average sportsman, in the fox squirrel as a species with the requisite sporting qualities.

From this situation has arisen the problem of keeping the volume of hunting and the population of the species in proper relationship. This involves restriction of open season and hunting privileges when some factor decreases the population and of retarding population increase should it get too high.

In order that a species be managed properly with respect to the various phases of its environment, there must be some reliable method by which knowledge of population fluctuations can be obtained. Since observations of this nature are made chiefly by county conservation officers and other field workers of conservation commisions, the inventory method used must be simple of application, must not require too much time and must give a dependable indication of numbers present.

It was with these qualities in mind that the research work as outlined in this paper was undertaken.

Classification of vegetative growth was made according to Gray's "New Manual of Botany" and Sargent's "Manual of Trees of North America."

In selecting the area on which observations were to be made, it was thought advisable to choose a tract on which there was very little hunting. Although the influence of this factor was confined to the fall months during open season, elimination of this variable for the most part led to simpler interpretation of data.

REVIEW OF LITERATURE

A comparatively small amount of literature has appeared concerning the life history and management of the western fox squirrel. Accordingly there have been very few publications treating of the relative merits of various inventory methods.

Goodrum of Texas (1937) presented accounts of several census methods used to determine squirrel populations. One of these, known as "time-area" count, involves random selection of observation stations when squirrels are most active. A definite length of observation time is used and the area observed is approximated. A second method includes leaf nests as the determining factor and is called the "nest-area" count. A third is known as the "time-space" method. A hunting dog is used for more complete enumeration. Approximation of the area traversed was made by comparing the time required to cover it with the time required to cover a tract of known area.

Dice (1931) summarized general methods to be used for indicating the abundance of mammals. In 1938 he gave a summary of several inventory techniques and emphasized the practicable and impracticable qualities of each.

Chapman (1938) made brief mention of several methods used in population studies of the Ohio gray squirrel investigation. The spot count method and leaf nest method gave nearly identical results. They were used for summer count. For fall count a hunter tally system was used. Hunters working over a known area kept records of the numbers of squirrels seen. In this manner values of individuals for unit of area were obtained. For determining winter populations the spot count and tracks in snow were used.

Baumgartner (1938) outlined several methods of census techniques among which were the leaf nest count, spot count, exhaustive trapping and tagging and two mathematical calculation methods. √The leaf nest count is good when properly used but in applying it there are several factors which test its accuracy. Caution must be exercised to distinguish between winter and summer nests, used and non-used nests. In addition, leaf nests are often extremely difficult to find amongst dense summer foliage. There is always the possibility of confusing squirrel nests with other animal nests of a similar nature. The spot count cannot be used efficiently on ungrazed woodlands since first story growth would so delimit visibility that a true count could not be obtained. Since inventory by this method depends upon animal activity, observations would necessarily have to be made under comparable conditions. Season of year, food conditions, temperature and time of day, are a few of the influencing factors needed to be considered in using this method. Naturally such a procedure is quite slow and in many instances would be impractical. Amount of time required and the problem of moving equipment are the two major difficulties encountered in this method. The computation methods depend upon the percentages of tagged animals that are retaken. They have proven to be fairly accurate for large areas, but there is greater chance for error as the tract is decreased in area.

THE INVESTIGATION

Locality

When initial studies were begun in April, 1938, it became evident that a compact area embracing extreme variations in topography and vegetation were desirable. Observations made from such a tract would be more easily compared and would have greater significance than if separate tracts were investigated. Even with the first mentioned arrangement there was a greater number of variables than would permit easily made comparisons.

The area of investigation consisted of 250 acres along Squaw Creek in Sections 29, 32 and 33, Franklin Township, Story County. Most of the area was subject to grazing by cattle, and those ungrazed tracts did not have sufficient underbrush and second growth to interfere with enumeration. There were 100 acres of flood plain which supported blue grass (*Poa pratensis*), hemp (*Cannabis sativa*), ragweeds (*Ambrosia artemisiifolia* and *A. trifida*), gooseberry (*Ribes Cynosbati*), prickly ash (*Xanthoxylum americanum*), buckbrush (*Symphoricarpos* spp.), hawthorn (*Crataegus* spp.), crabapple (*Pyrus ioensis*), honey locust (*Gleditsia triacanthos*), bur oak (*Quercus macrocarpa*), silver maple (*Acer saccharinum*), black maple (*A. nigrum*), box elder (*A. negundo*), American elm (*Ulmus americana*), red elm (*U. fulva*), hackberry

(*Celtis occidentalis*), sycamore (*Platanus occidentalis*), black willow (*Salix nigra*), cottonwood (*Populus deltoides*), basswood (*Tilia americana*), black ash (*Fraxinus nigra*), and black walnut (*Juglans nigra*). The rough terrain consisted of 150 acres of wooded ridges and gullies. On the ridges were to be found blue grass, sedges (*Carex* spp.), wild gooseberry, May apple (*Podophyllum peltatum*), ironwood (*Ostrya virginiana*), serviceberry (*Amelanchier canadensis*), bur oak, white oak (*Quercus alba*), red oak (*Q. borealis maxima*), black maple, basswood and hickory nut (*Hicoria ovata*). Gullies supported blue grass, wild gooseberry, buckbrush, prickly ash, wild crabapple, wild plum (*Prunus nigra*), basswood, red oak, American elm, bur oak, black walnut, butternut (*Juglans cinerea*), hackberry and mulberry (*Morus* spp.).

Methods

In this investigation two methods were used. The first can be termed simply a "linear" count. It involved pursuit of a definite route of known width and length with tabulation of all individuals seen. While following the procedure of this method, the worker used several routes varying in length from two miles to a quarter of a mile. Since the width was variable and depended upon seasonal factors, it will be discussed later. Selection of routes was made so as to include a wide variety of vegetation and of topographic contour.

The second is known popularly as the "spot" count. For this method two adjacent tracts of approximately 20 acres each were selected. Both were comparable as to vegetative types and topography. Each observation lasted 30 minutes. A total of four observations each half day were made with two observations occurring on one tract and two on the other. As far as possible, random selection of count spots was made at all times.

In addition to topographic differences and variations in vegetative types, there were many other variables which influenced fox squirrel activity. Attempts were made to observe the effects of these factors. Undoubtedly temperature was an exceedingly important factor in determining the degree and possibly, to a lesser extent, the time of activity. Another very important factor was time of day at which observations were made, and on a larger scale, the time of year or seasonal influence. There follow also as factors of greater or lesser importance, such meteorological influences as humidity, wind velocity, degree of cloudiness and precipitation.

Presentation of Data

Temperature

In an attempt to explain the relationship of temperature to animal activity the data are presented in the following table. As presented, this set of data represents observations made in both inventory methods. It was discovered that a separation of the data for each method was purposeless.

TABLE I

CORRELATION OF SQUIRREL COUNTS AND TEMPERATURE

Temperature in Degrees F.	Number of Squirrels Observed	Number of 30-minute Observation Periods
5		
6		
7		
8		1
9		0
10		2
11	1	1
12	0	3
13	1	2
14	4	2
15	3	1
16	1	2
17	1	1
18	2	2
19	5	2
20	6	1
21	2	3
22	1	3
23	1	4
24	1	3
25	0	2
26	5	3
27	8	5
28	5	5
29	3	4
30	2	4
31	0	3
32	1	4
33	0	5
34	3	6
35	0	0
36	1	5

(Continued)

TABLE I
(Continued)

Temperature in Degrees F.	Number of Squirrels Observed	Number of 30-minute Observation Periods
37	0	2
38	7	2
39	3	4
40	5	4
41	4	6
42	1	4
43	1	7
44	2	8
45	2	4
46	4	3
47	9	6
48	6	2
49	4	3
50	6	4
51	5	1
52	2	3
53	0	2
54	5	1
55	4	3
56	2	2
57	1	3
58	3	6
59	1	6
60	4	5
61	6	9
62	6	8
63	3	6
64	3	9
65	4	10
66	4	6
67	3	4
68	3	6
69	4	6
70	5	7
71	5	7
72	4	4
73	7	7
74	3	9
75	4	10
76	1	6
77	2	5
78	10	9
79	0	5

(Continued)

TABLE I
(Continued)

Temperature in Degrees F.	Number of Squirrels Observed	Number of 30-minute Observation Periods
80	7	7
81	3	7
82	2	7
83	5	13
84	1	8
85	3	8
86	4	7
87	0	2
88	3	4
89	1	3
90	5	3
91	2	1
92	2	2
93	1	2
94	3	1
95	0	2
96	0	2
97	0	1
98	0	0
99	0	0
100	0	2
101	0	2

From the figures given for temperature relationship it is seen that the amount of animal activity below 14° F. is negligible. From 14° F. to 55° F. activity was extremely erratic. Ratios of number of squirrels seen to number of observation periods for various temperatures within this bracket go from depths to heights graphically depicted. It is not possible to explain this radical ratio variation by temperature effect alone. But when this factor is considered with cloudiness, humidity and wind velocity, then a plausible explanation can be given. An observation made at a 20° F. temperature, but with bright sunshine and a quiet atmosphere, might yield a high ratio since such conditions would be much more conducive to animal activity than would observation conditions of the same temperature but with cloudy sky and driving wind. Even though the ratio for 11° F. to 20° F. as shown on the graph has the highest value of any ratio for groups of ten temperatures, this by no means indicates that the range of 11° F. to 20° F. is the best temperature at which inventory could be made.

The graph lines for ratios of intervals of five degrees and ten degrees indicate much greater constancy within ranges of 55° F. to 85° F. An explanation for this follows in the same manner as that given for the lower temperature bracket, only in this bracket temperature and other weather conditions are not so erratic or extreme. Consequently they exert a steadying influence on animal activity.

In the next higher temperature range, 85° F. to 101° F., the extreme variation common to the first bracket is again in evidence. From this it appears that temperature (a major but not sole factor) away from normal tends to make animal activity erratic. Therefore, it may be concluded that a more representative inventory could be made at temperatures of the 55° F. to 85° F. bracket.

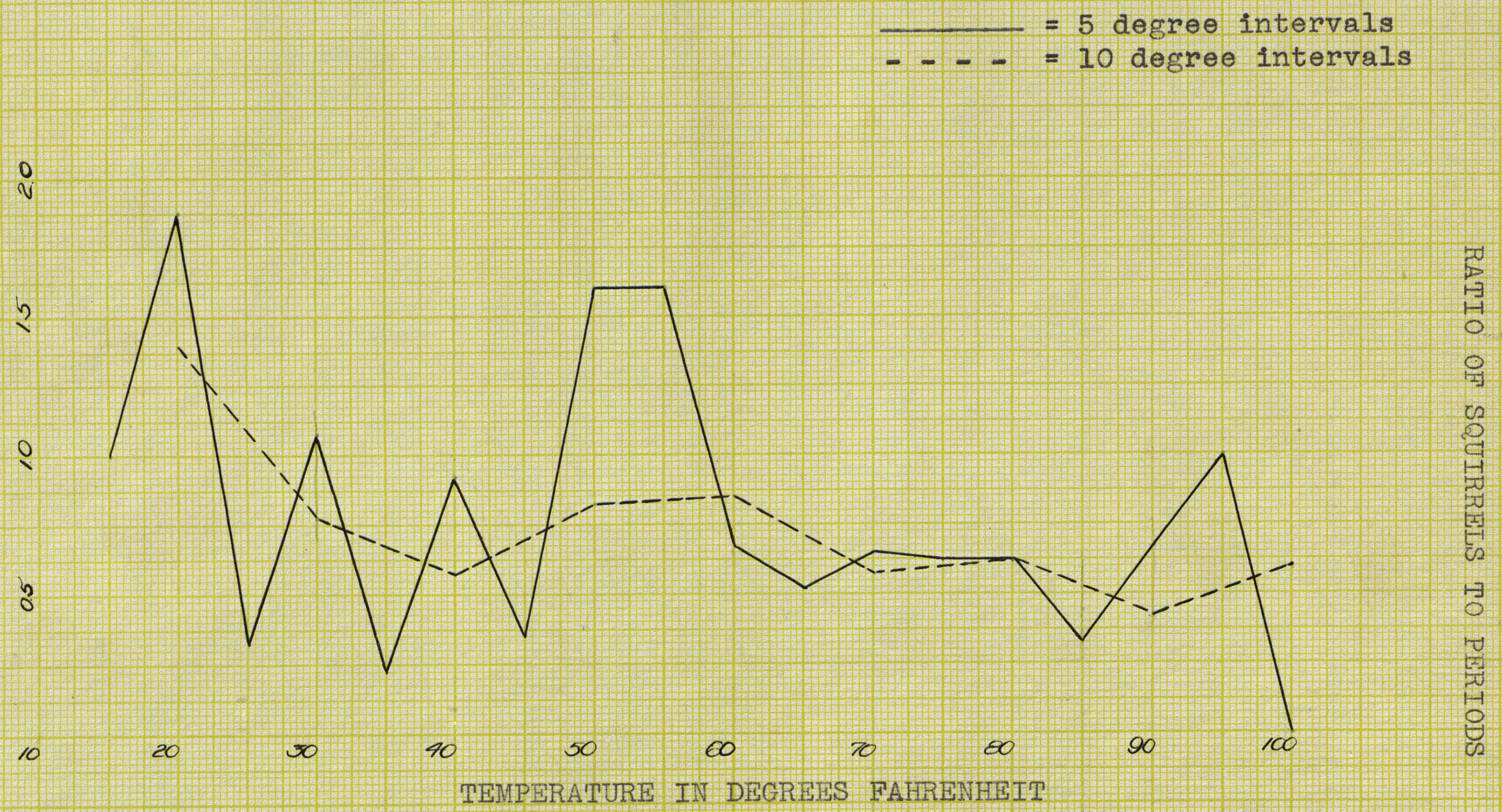

Fig. 1. Relationship between temperature and ratio of number of squirrels to number of 30-minute observation periods.

An examination of the figures reveals that throughout the temperatures at which observations were made, there were relatively more periods below 55° F. and above 85° F. at which no animals were recorded.

Cloudiness

TABLE II

CORRELATION AMONG DEGREE OF CLOUDINESS, ANIMAL ACTIVITY AND OBSERVATION TIME

Condition of Sky	Number of 30-minute Observation Periods	Number of Squirrels seen	Squirrels / Periods
Cloudy	99 (25%)	48 (18%)	0.485
Partly Cloudy	86 (22%)	65 (25%)	0.756
Clear	209 (53%)	149 (57%)	0.714
TOTAL	394	262	

With some animals we often associate sunshiny weather with more pronounced activity. There is always a certain fairly constant amount of activity, however, regardless of the degree of clearness. Hunger is an impelling force which must be satisfied, and neither sunshine nor clouds will vary the amount of time spent in foraging as greatly as other activities of a minor nature. In regard to these other types of activity, which may be included in the terms of exploration, play, and loafing, cloudiness may exercise a direct influence.

It is easy to assume that a balmy, sunny day would be much more conducive to taking sun baths and general loafing activity than a day modified by an overcast sky.

An examination of table II shows that the ratio of number of squirrels to number of observation periods is highest for partly cloudy days followed closely by clear days. The group of totally cloudy days gives a much lower ratio than either of the two previous categories. It is seen also that cloudy days formed 25 percent of total observation time but only 18 percent of total number of squirrels seen were recorded in this division. Partly cloudy days yielded 22 percent of observation time with 25 percent of squirrels seen, and clear days comprised 53 percent of observation time and 57 percent of total animals recorded.

From these figures it is apparent that it makes small difference as to whether sunshine is steady or intermittent, there is approximately the same amount of activity for respective observation time. Continuous cloudiness, however, seems to cause decreased activity. Excessively high temperatures may be cited as the reason for a slightly lower ratio for clear days than for partly cloudy days.

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effect of presence and absence of leaves will be discussed further later on.

Season

A broader portrayal of movement in the form of seasonal activity is given below for comparative purposes.

TABLE IV

CORRELATION AMONG SEASON OF YEAR, TOTAL NUMBER OF OBSERVATION PERIODS, TOTAL NUMBER OF SQUIRRELS SEEN, TOTAL NUMBER OF ACRES OBSERVED, RATIO OF SQUIRRELS SEEN TO OBSERVATION PERIODS AND RATIO OF SQUIRRELS SEEN TO ACREAGE OBSERVED

Season	Number of 30-minute Observation Periods	Number of Squirrels	Acres Observed	Squirrels / Obs. Periods	Squirrels / Acres
Winter					
Dec. 22 to March 21	77	35	534	0.45	0.066
Spring					
March 22 to June 21	165	95	696	0.58	0.014
Summer					
June 22 to Sept. 21	75	34	207	0.45	0.016
Autumn					
Sept. 22 to Dec. 21	91	91	801	1.00	0.011
TOTAL	408	255	2238		

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TABLE VI

CORRELATION AMONG TIME OF DAY, NUMBER OF 30-MINUTE OBSERVATION PERIODS, NUMBER OF SQUIRRELS AND RATIO OF SQUIRRELS TO PERIODS FOR LINEAR METHOD

Time of Day	Number of 30-minute Observation Periods	Number of Squirrels	$\frac{\text{Squirrels}}{\text{Periods}}$
7 - 8	2	2	1.00
8 - 9	8	13	1.63
9 -10	19	32	1.69
10 -11	15	17	1.13
11 -12	7	1	0.14
1 - 2	18	6	0.33
2 - 3	22	15	0.68
3 - 4	16	8	0.50
4 - 5	10	5	0.50

TABLE VII

FREQUENCY RELATIONSHIP BETWEEN NUMBERS OF SQUIRRELS SEEN FOR EACH OBSERVATION PERIOD AND NUMBERS OF 30-MINUTE PERIODS FOR LINEAR METHOD

Number of Squirrels	Number of 30-minute Periods	Percent of Total
0	70	60
1	25	21
2	9	8
3	6	5
4	3	3
5	1	
6	1	
7	0	3
8	1	
9	1	

TABLE VIII

RELATIONSHIP AMONG MONTH OF OBSERVATION, AMOUNT OF OBSERVATION TIME, AREA OBSERVED AND COUNT FOR SPOT METHOD

Month	Number of Periods of Observation Time	Number of Squirrels	Acres Observed	Squirrels / Periods	Squirrels / Acres
Jan.	30	13	189	0.43	0.07
Feb.	24	10	150	0.42	0.07
Mar.	32	15	200	0.47	0.08
Apr.	36	24	225	0.66	0.11
May	36	9	54	0.25	0.17
June	32	16	48	0.50	0.33
July	8	1	12	0.12	0.08
August	12	1	18	0.08	0.06
Sept.	32	20	48	0.62	0.42
Oct.	36	38	64	1.05	0.59
Nov.	7	9	82	0.69	0.11
Dec.	0	0	0	0.00	0.00
TOTAL	291	156	1090	0.48	0.19

TABLE IX

CORRELATION AMONG TIME OF DAY, NUMBER OF 30-MINUTE OBSERVATION PERIODS, NUMBER OF SQUIRRELS AND RATIO OF SQUIRRELS TO PERIODS FOR SPOT METHOD

Time of Day	Number of 30-minute Observation Periods	Number of Squirrels	Squirrels / Periods
7 - 8	2	1	0.50
8 - 9	35	36	1.03
9 -10	65	54	0.83
10 -11	44	34	0.77
11 -12	4	2	0.50
1 - 2	25	9	0.36
2 - 3	59	11	0.19
3 - 4	44	7	0.16
4 - 5	12	2	0.16
5 - 6	1	0	0.00

TABLE X

FREQUENCY RELATIONSHIP BETWEEN NUMBERS OF SQUIRRELS SEEN FOR EACH OBSERVATION PERIOD AND NUMBERS OF 30-MINUTE PERIODS FOR SPOT METHOD

Number of Squirrels	Number of 30-minute Periods	Percent of Total
0	193	66
1	59	20
2	23	8
3	10	4
4	3	
5	2	2
6	1	

TABLE XI

RELATIONSHIP AMONG EFFECT OF FOLIAGE AND ACREAGE OBSERVED, SQUIRRELS SEEN AND RATIO OF SQUIRRELS TO ACRES FOR LINEAR COUNT. THIS TABLE INCLUDES DATA FOR THE MONTHS OF MAY TO OCTOBER, INCLUSIVE

Time of Day	Number of Squirrels	Acreage	$\frac{\text{Squirrels}}{\text{Acres}}$
7 - 8	1	9.1	0.220
8 - 9	8	35.1	0.228
9 -10	10	33.5	0.286
10 -11	6	33.5	0.179
11 -12	0	1.3	0.000
1 - 2	5	18.1	0.276
2 - 3	14	59.1	0.254
3 - 4	8	65.6	0.137
4 - 5	5	50.5	0.099

TABLE XII

RELATIONSHIP AMONG EFFECT OF DEFOLIATION AND ACREAGE OBSERVED, SQUIRRELS SEEN AND RATIO OF SQUIRRELS TO ACRES FOR LINEAR COUNT. THIS TABLE INCLUDES DATA FOR THE MONTHS OF APRIL, NOVEMBER AND DECEMBER

Time of Day	Number of Squirrels	Acreage	Squirrels / Acres
7 - 8	0	0	0.000
8 - 9	5	49.9	0.100
9 -10	22	233.1	0.099
10 -11	11	207.1	0.063
11- 12	1	182.0	0.005
1 - 2	1	76.2	0.013
2 - 3	1	93.9	0.011
3 - 4	0	0	0.000
4 - 5	0	0	0.000

TABLE XIII

RELATIONSHIP AMONG EFFECT OF FOLIAGE AND ACREAGE OBSERVED, SQUIRRELS SEEN AND RATIO OF SQUIRRELS TO ACRES FOR SPOT COUNT. DATA FOR THE MONTHS OF MAY TO OCTOBER INCLUSIVE ARE GIVEN

Time of Day	Number of Squirrels	Acreage	Squirrels / Acres
7 - 8	1	1.5	0.657
8 - 9	25	31.6	0.791
9 -10	29	50.1	0.579
10 -11	17	41.6	0.409
11 -12	1	5.1	0.196
1 - 2	6	22.6	0.266
2 - 3	3	49.8	0.060
3 - 4	2	34.6	0.057
4 - 5	1	3.4	0.294

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DISCUSSION

A glance at tables V and VIII indicates that the average ratios of squirrels to acres for both linear and spot methods vary from each other by only 0.02. The average ratios of squirrels to observation periods offer a different relationship, however. The average ratio given for linear count is 1.77 times as great as the corresponding ratio for spot count. In comparing these two sets of data an examination of Figure 3 indicates extreme variations between the two methods. In general, it is noticed that both methods offer two peaks of plotted values. A minor rise is indicated in the spring months and a major rise is shown for autumn and early winter. Here again the mid-summer drop is plainly evident, and the exceptional activity during September, October, November and December is borne out again. No reasons can be advanced to account for such wide variation as shown for May and October. Other variables undoubtedly had their influence.

A consideration of Figure 4 reveals in the case of the spot method, two high peaks. This means some factor is the cause for decreased acreage values or for increased numbers of squirrels observed. Here is shown quite clearly the effect of foliage in delimiting acreage observation. Values for January, February, March, April, November and

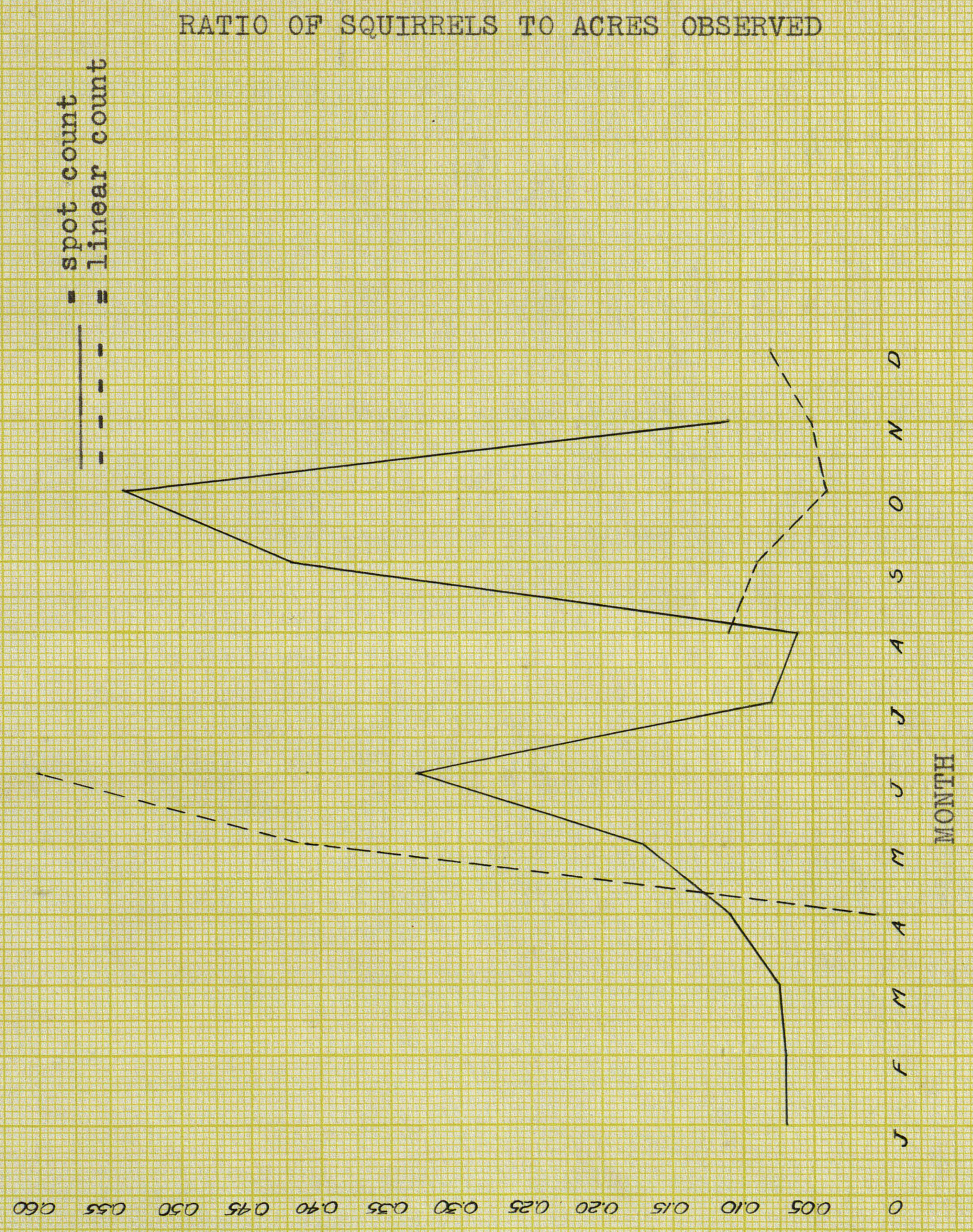

Fig. 4. Relationship between month and ratio of number of squirrels to number of acres observed.

December are comparatively low, but with foliation the values rise abruptly. It would be thought that July and August should display the same high trend, provided there was no factor to affect the numerator of the ratio. However, there is a direct influence in heat which we have encountered several times previously. Again the graph behaves in a manner very difficult to explain in the light of preceding statements. The values for September, October, November and December are much too low relatively speaking.

Figure 5 is a substantiation of tables VI and IX. A comparison of forenoon and afternoon values for each method indicates very clearly that animal activity is much greater during the forenoon, especially from eight o'clock to ten o'clock. Activity in the afternoon appears to remain at a comparatively low ebb with minor fluctuations.

In the use of both methods by far the greatest number of observation periods resulted in no squirrels being seen. This frequency class includes 60 percent and 66 percent of total observation time. Periods in which one squirrel was seen comprise one-fifth of total time. Frequencies of values from two to nine decrease very rapidly as percent of total time. It will be noticed that percentages of both methods are rather close. The greatest discrepancy is in the percentages for no squirrels seen, where that for spot method exceeds that for linear.

Various values for <u>s</u> have been computed previously

Form E-2

Fig. 5. Relationship between time of day and ratio of number of squirrels to number of observation periods for spot count.

Fig. 6. Relationship between time of day and ratio of number of squirrels to number of observation periods for linear count.

and are given here with their respective set of conditions. Since each of these values represents an

linear foliate	0.0302
spot foliate	0.0594
linear defoliate . . .	0.0196
spot defoliate	0.0150

average of variation, it can be said that there is greatest variability among ratio values of squirrels recorded to acres observed for various hours of the day when the spot method is used in a foliated environment. The least variation occurs when spot count is used in a defoliated environment. A comparison of foliate and defoliate environments clearly shows that an inventory taken throughout a day by either linear or spot count when foliage is present is susceptible to greater variation than when foliage is absent. So it appears that various hourly counts tend to be more constant in a defoliated habitat. Putting aside distinctions between effects of foliage and defoliation, a similar comparison can be made between the two count types. The two values for linear count yield a smaller sum than do those for spot count. Following the same line of reasoning, it can be stated that the linear count yields results subject to less variation than does the spot count.

In attempts to compare the two methods, each is found to have its advantages. In using the linear count, more territory can be covered in a shorter time. However, it is not so comprehensive, for the time spent in a locality is rather short. Approach of the one taking inventory may often disturb normal squirrel activity. A very common disturbance is rustle of dead leaves which are plentiful at all seasons in stands of oaks and maples. This factor enters also in the spot count when an observation point is being approached. However, the quiet which follows stationing is conducive to the resumption of usual activity. In addition to obtaining an inventory, quiet observation often affords insight into animal activity. In this manner various activity phases can be watched. There is always the possibility that further insight can be gained in regard to food habits, family relationships and conduct during play and exercise.

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when the squirrels are foraging and building nests in preparation for winter. A low ebb in activity occurs in July and August when excessive heat tends to discourage movement.

5. For the linear count, data were collected during April, May, June, August, September, October, November and December. For the spot count data were taken at all months except December. In using the linear count 117 30-minute periods of observation time were devoted to linear count; 291 periods to spot count. In the use of the former, 99 squirrels were tabulated and for the latter, 156 were recorded. Total acres observed were 1148 for the linear method and 1090 for the spot method. Average ratio of number of squirrels seen to periods of observation time for the former was 0.85, for the latter 0.48. In the same sequence the ratios of numbers of squirrels seen to acres of territory observed were 0.17 and 0.19.

6. Time of day is very important in a consideration of squirrel activity. Forenoons, especially from eight o'clock to ten o'clock, display much greater activity than do afternoons.

7. The percent of observations at which no squirrels were recorded was far greater than any other numerical category for either linear or spot count. Of total observation time, those periods during which no squirrels

were seen comprised 66 percent for spot count and 60 percent for linear count.

8. In taking inventory, presence or absence of foliage is an important factor in the relationship between individuals tabulated and acreage under observation.

9. Standard deviation can be used effectively as a measure of result variation. Results of the spot method employed during full foliage are found to display greatest variation with respect to various hours of the day. In addition a defoliate environment yields more constant results than does one with foliage. In this respect the linear count shows less variation in results than does the spot count.

10. Each of the two methods has its advantages and disadvantages. In using the linear count it is often impossible to get a true population estimate because of a disturbing approach with consequent cessation of animal activity. Individuals may be omitted from tabulation by the rapidity of the method itself. The spot method is more time consuming but offers a chance to gain other pertinent information besides inventory data.

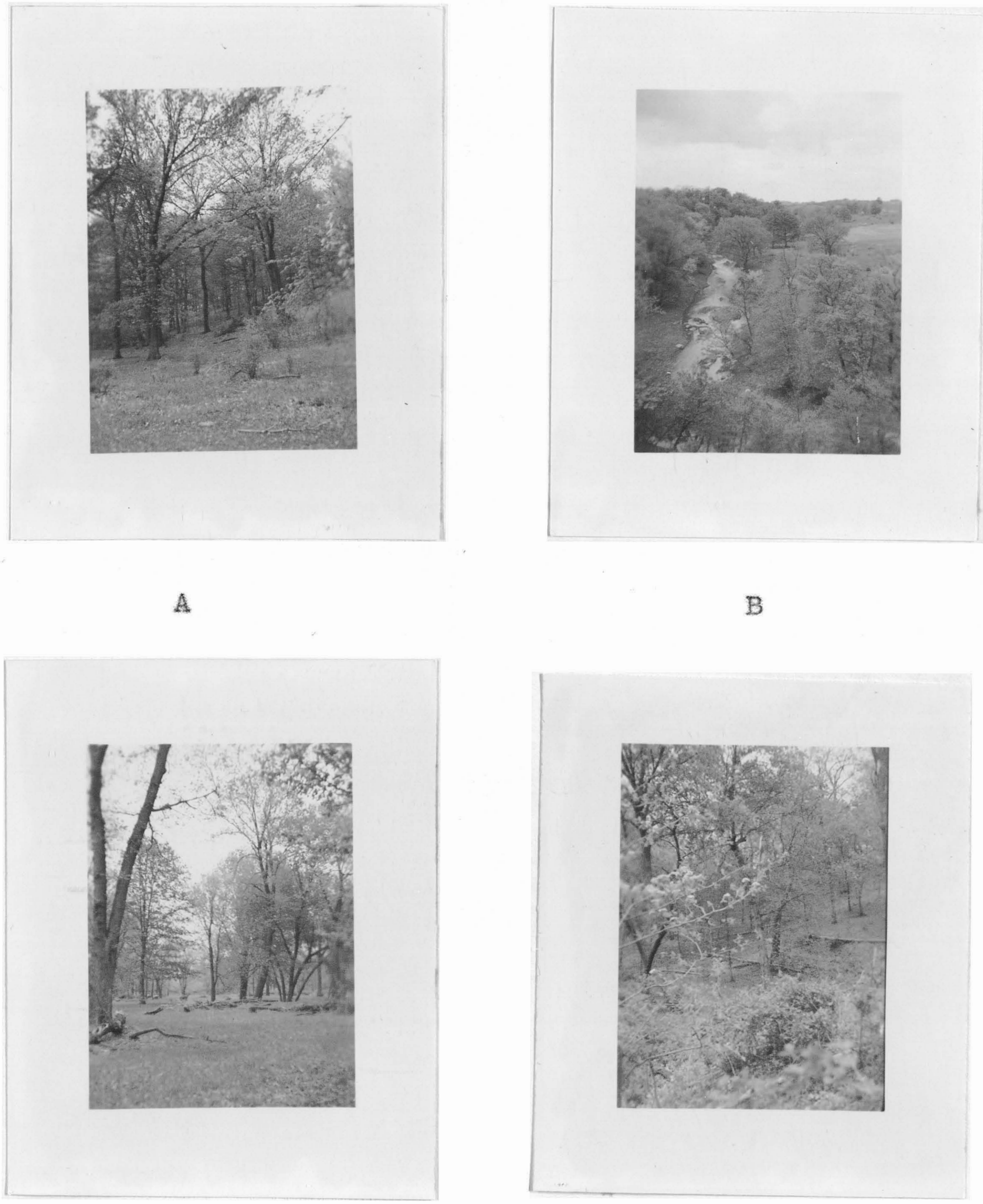
A

B

C

D

Fig. 8. Four distinct types of defoliated habitat showing the wide range of vision.



A B

C D

Fig. 9. Habitat types as shown in Figure 8 with full foliage.

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